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PATENT
Attorney Docket No. BSC-031CN

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT(S):	Crowley		
SERIAL NO.:	Not Yet Assigned	GROUP NO.:	Not Yet Assigned
FILING DATE:	Herewith	EXAMINER:	Not Yet Assigned
TITLE:	Readable Probe Array For In-Vivo Use		

Box PATENT APPLICATION
Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

PRELIMINARY AMENDMENT

Prior to examination, please enter this Preliminary Amendment and consider the following remarks:

In the Written Description:

On page 1, before "Background of the Invention," please insert the following paragraph:

This is a continuation of prior application Serial No. 09/233,4098, filed on January 19, 1999, which is based on U.S. provisional patent application Serial no. 60/071,906, filed on January 20, 1998. The entire disclosure of both applications is incorporated herein by reference.

Please replace the paragraph spanning pages 3 and 4 with the following paragraph:

Probe materials generally are engineered molecular materials that are designed to have an affinity to one or more constituents that may be expected to be found in the tissue, fluid or chemical mix to be analyzed. These probe

materials may be made sensitive to specific genes or gene segments through complimentary genetic indicators that have been designed to fluoresce or change color, as observed by the naked eye or by spectrographic analysis methods, when they are linked to a molecule to which they have affinity. A large number of different types and combinations of optically readable probes are being manufactured today that have specific affinity to one or more genes, proteins or other chemicals. In preferred embodiments, the present invention contemplates the use of two classes of probes: (i) protein sensitive probes, such as GFP (green fluorescent probe) from the jellyfish *Aequorea victoria*; and (ii) modified oligonucleotide probes that are fluorogenic, such as those manufactured by Synthegen LLC, Houston, Texas 77042. Additional probes suited for use in the present invention are available from Midland Certified Reagent Company, Midland, Texas 79701, and Transbio Corp., Blatimore, Maryland 21220. Typically these probes must be used *in vitro* due to either their lack of biocompatability or because they must be used in conjunction with aggressive reagents that are toxic to cells.

In the Drawings:

Please substitute 7 sheets of informal drawings (Figures 1-6) with 7 sheets of ***formal*** drawings (same Figures 1-6).

In the Claims:

Please cancel claims 25 and 33-43, amend claims 1-3, 6-8, 11-16, 26-28, 31, and 32, and add new claims 44-88 to read as follows:

1. (Amended) A body-insertable apparatus comprising:

an excitation source capable of generating radiation;

at least one probe disposed in a path of said radiation, said probe situated to contact an analyte;

a detector for detecting optical properties of said probe, said detector also for converting optical signals representative of the detected optical properties to electrical signals;

and a housing adapted for reaching an area of interest within a body,

wherein said excitation source, said probe, and said detector are disposed in said housing.

2. (Amended) The apparatus of claim 1 wherein said probe binds to an oligonucleotide.

3. (Amended) The apparatus of claim 1 wherein said probe binds to a protein.

6. (Amended) The apparatus of claim 1 wherein said probe comprises an array of sub-probes.

7. (Amended) The apparatus of claim 6 wherein said array comprises a readable polydeoxynucleotide array.

8. (Amended) The apparatus of claim 6 wherein said array is disposed in a plurality of chambers within a frame.

11. (Amended) The apparatus of claim 1 further comprising optics that affects said path of radiation.

12. (Amended) The apparatus of claim 11 wherein said optics comprises a mirror.

13. (Amended) The apparatus of claim 12 wherein said mirror is adjustable.

14. (Amended) The apparatus of claim 1 wherein said body-insertable apparatus is electrically connected to a processing unit.

15. (Amended) The apparatus of claim 1 wherein said body-insertable apparatus is electrically connected to an amplifier.

16. (Amended) The apparatus of claim 1 wherein said body-insertable apparatus is electrically connected to a display.

26. (Amended) The apparatus of claim 1 wherein said body-insertable apparatus comprises a catheter.

27. (Amended) The apparatus of claim 1 wherein said body-insertable apparatus defines one or more lumens extending through the length of said body-insertable apparatus.

28. (Amended) The apparatus of claim 27 wherein said lumen delivers a drug, a reagent or a device to or beyond the distal tip of said body-insertable apparatus.

31. (Amended) The apparatus of claim 1 wherein said detector detects light emission at multiple wavelengths.

32. (Amended) The apparatus of claim 31 wherein said detector comprises a photodiode.

44. (New) A method of performing in vivo examination of a mammalian body, said method comprising:
(a) providing a device comprising an excitation source, at least one probe, a detector and a housing, wherein said excitation source, said probe and said detector are disposed in said housing;
(b) inserting said device into said mammalian body until said probe contacts an analyte in an area of interest;
(c) generating radiation from said excitation source such that said probe is in a path of said radiation;
(d) detecting an optical signal representative of an optical property of said probe through said detector; and
(e) converting said optical signal to an electrical signal.

45. (New) The method of claim 44 wherein said analyte comprises an oligonucleotide.

46. (New) The method of claim 44 wherein said analyte comprises a protein.

47. (New) The method of claim 44 wherein said probe is fluorescently labeled.

48. (New) The method of claim 44 wherein said probe is attached to a substrate.

49. (New) The method of claim 44 wherein said probe comprises an array of sub-probes.

50. (New) The method of claim 49 wherein said array comprises a readable polydeoxynucleotide array.

51. (New) The method of claim 49 wherein said array is disposed in a plurality of chambers within a frame.

52. (New) The method of claim 51 wherein said frame comprises a molded material.

53. (New) The method of claim 51 wherein said frame comprises a foraminous material.

54. (New) The method of claim 44 further comprising using optics to affect said path of radiation.

55. (New) The method of claim 54 wherein said step of using optics comprises adjusting a mirror.

56. (New) The method of claim 44 further comprising transmitting and processing said electrical signal.

57. (New) The method of claim 44 further comprising amplifying said electrical signal.

58. (New) The method of claim 44 further comprising displaying said electrical signal.

59. (New) The method of claim 48 further comprising mixing said probe with an ink to form a probe-filled ink and depositing said probe-filled ink upon said substrate.

60. (New) The method of claim 59 further comprising depositing a plurality of probe-filled inks upon said substrate in a specific ink pattern.

61. (New) The method of claim 60 further comprising protecting said ink pattern with a topcoat.

62. (New) The method of claim 61 wherein said topcoat comprises a dissolvable gel.

63. (New) The method of claim 61 wherein said topcoat comprises a polymer material dissolvable only upon application of a solvent.

64. (New) The method of claim 44 wherein said detector comprises a spectrometer module.

65. (New) The method of claim 44 further comprising encapsulating said spectrometer module in an at least partly transparent housing.

66. (New) The method of claim 44 wherein said excitation source comprises a light-emitting diode.

67. (New) The method of claim 44 wherein step (c) comprises generating radiation of wavelengths in a range from about 1100 nm to about 250 nm.

68. (New) The method of claim 44 wherein said detector comprises a photodiode responsive to said optical signal from said probe.

69. (New) The method of claim 44 wherein said detector comprises a light wavelength detection system.

70. (New) The method of claim 69 wherein said light wavelength detection system comprises a bandpass filter.

71. (New) The method of claim 44 wherein said device comprises a catheter.

72. (New) The method of claim 44 wherein said device defines at least one lumen extending through the length of said device.

73. (New) The method of claim 72 further comprising delivering a drug, a reagent or a device through said lumen to or beyond a distal tip of said device to affect said area of interest.

74. (New) The method of claim 72 further comprising using said lumen to provide suction such that said analyte is drawn into contact with said probe.

75. (New) The method of claim 44 further comprising introducing to said area of interest a lysing system to facilitate contact between said analyte and said probe.

76. (New) The method of claim 75 further comprising using ultrasonic energy to rupture a cell membrane at said area of interest.

77. (New) The method of claim 75 further comprising using a pressurization and evacuation system to rupture a cell membrane at said area of interest.

78. (New) The method of claim 75 further comprising using a mechanical force to rupture a cell membrane at said area of interest.

79. (New) The method of claim 78 further comprising using a lysing head driven by a driveshaft to rupture said cell membrane.

80. (New) The method of claim 44 further comprising implanting said device in said mammalian body.

81. (New) The method of claim 44 further comprising anchoring said device in said area of interest through an anchor.

82. (New) The method of claim 81 wherein said anchor comprises a therapeutic tip for administering a therapeutic agent.

83. (New) The method of claim 82 wherein said therapeutic tip is separable from the rest of said device such that said therapeutic tip remains within the area of interest after removal of said device.

84. (New) The method of claim 82 wherein said therapeutic tip is retrievable.

85. (New) The method of claim 84 wherein said therapeutic tip is retrievable through a tether attached to said therapeutic tip.

86. (New) The method of claim 82 further comprising controlling a function of said therapeutic tip from outside said body by transmitting an electrical signal through a tether attached to said therapeutic tip.

87. (New) The method of claim 44 further comprising using a carrying device to deliver said device to the area of interest.

88. (New) The method of claim 87 wherein said carrying device is selected from the group consisting of a hollow needle, a guide wire, a balloon catheter, an ultrasound catheter, an introducer sheath, and a balloon angioplasty catheter.

Remarks

Applicant hereby amends the specification to provide information about related applications, to assert right of priority under 35 U.S.C. §§ 120 and 119(e), and to correct typographical errors. A marked-up copy of the amended paragraph and a clean copy of the amendment are attached. Formal drawings are also attached and submitted to substitute the informal drawings originally filed in the parent case. No new matter is added.

Claims 25 and 33-43 are canceled without prejudice. Claims 1-3, 6-8, 11-16, 26-28, 31, and 32 are amended. And new claims 44-88 are added. All the amendment and new claims are supported by the Specification and the claims as originally filed. A marked-up copy of all

amendments to the claims and a clean copy of all pending claims are attached. Applicant respectfully submits that no new matter is added and that all pending claims, i.e., claims 1-24, 26-32, and 44-88 are in condition for allowance.

CONCLUSION

If the Examiner believes that a telephone conversation with Applicant's attorney would expedite allowance of this application, the Examiner is cordially invited to call the undersigned attorney at (617) 248-7808.

Respectfully submitted,

Date: June 14, 2001
Reg. No. (Limited Recognition)

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Marked-up Copy of Amendment to Specification

The paragraph spanning pages 3 and 4 is hereby amended to read as follows:

Probe materials generally are engineered molecular materials that are designed to have an affinity to one or more constituents that may be expected to be found in the tissue, fluid or chemical mix to be analyzed. These probe materials may be made sensitive to specific genes or gene segments through complimentary genetic indicators that have been designed to fluoresce or change color, as observed by the naked eye or by spectrographic analysis methods, when they are linked to a molecule to which they have affinity. A large number of different types and combinations of optically readable probes are being manufactured today that have specific affinity to one or more genes, proteins or other chemicals. In preferred embodiments, the present invention contemplates the use of two classes of probes: (i) protein sensitive probes, such as GFP (green fluorescent probe) from the jellyfish *Aequorea victoria*; and (ii) modified ~~ohigonucleotide~~ oligonucleotide probes that are fluorogenic, such as those manufactured by Synthegen LLC, Houston, Texas 77042. Additional probes suited for use in the present invention are available from Midland Certified Reagent Company, Midland, Texas 79701, and Transbio Corp., Blatimore, Maryland 21220. Typically these probes must be used *in vitro* due to either their lack of biocompatability or because they must be used in conjunction with aggressive reagents that are toxic to cells.

Clean Copy of Addition and Amendment to Specification

On page 1, the following paragraph is hereby inserted before "Background of the Invention":

This is a continuation of prior application Serial No. 09/233,4098, filed on January 19, 1999, which is based on U.S. provisional patent application Serial no. 60/071,906, filed on January 20, 1998. The entire disclosure of both applications is incorporated herein by reference.

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Marked-up Copy of Amendment to Claims

1. (Amended) ~~A~~an body-insertable apparatus comprising:

an excitation source capable of generating radiation;

at least one ~~optically detectable~~ probe disposed in a path of said radiation ~~directed to an analyte~~, said probe situated to contact ~~said~~ an analyte;

a detector for detecting optical properties of said probe, said detector also for converting optical signals representative of the detected optical properties to electrical signals;

and a housing adapted for reaching an area of interest within a body,

wherein said excitation source, said probe, and said detector are disposed in said housing~~adapted for placement together in an area of interest within a body~~.

2. (Amended) The apparatus of claim 1 wherein said probe binds to ~~analyte is~~ an oligonucleotide.

3. (Amended) The apparatus of claim 1 wherein said probe binds to ~~analyte is~~ a protein.

6. (Amended) The apparatus of claim 1 wherein said probe comprises ~~is part of a probe~~ an array of sub-probes.

7. (Amended) The apparatus of claim ~~5~~6 wherein said ~~probe~~ array comprises ~~is~~ a readable polydeoxynucleotide array.

8. (Amended) The apparatus of claim 6 wherein said ~~probe~~ array ~~comprises~~ is disposed in a plurality of chambers within a frame.

11. (Amended) The apparatus of claim ~~5~~ 1 further comprising optics that affects said path of radiation. ~~wherein said probe is mixed with an ink to form a probe-filled ink and wherein said probe-filled ink is deposited upon said substrate.~~

12. (Amended) The apparatus of claim 11 wherein said optics comprises a mirror. ~~substrate comprises a sheet of plastic material.~~

13. (Amended) The apparatus of claim 12 ~~11~~ wherein said mirror is adjustable. ~~a plurality of probe-filled inks are deposited upon said substrate in a specific ink pattern.~~

14. (Amended) The apparatus of claim 1 ~~3~~ wherein said body-insertable apparatus is electrically connected to a processing unit. ~~ink pattern is protected by a topcoat.~~

15. (Amended) The apparatus of claim 1 ~~4~~ wherein said body-insertable apparatus is electrically connected to an amplifier. ~~topcoat comprises a dissolvable gel.~~

16. (Amended) The apparatus of claim 1 ~~4~~ wherein said body-insertable apparatus is electrically connected to a display. ~~topcoat comprises a polymer material dissolvable only upon application of a solvent.~~

25. (Cancelled) ~~The apparatus of claim 1 wherein said excitation source, said probe and said detector are positioned together within a body-insertable device~~.

26. (Amended) The apparatus of claim 1 ~~25~~ wherein said body-insertable ~~device~~ apparatus comprises a catheter.

27. (Amended) The apparatus of claim 1 ~~25~~ wherein said body-insertable ~~device~~ apparatus defines one or more lumens extending through the length of ~~the~~ said body-insertable ~~device~~apparatus.

28. (Amended) The apparatus of claim 27 wherein said lumen delivers a drug, a reagent or a device to or beyond the distal tip of said body-insertable apparatus~~device~~.

31. (Amended) The apparatus of claim 1 wherein said detector detects light emission at multiple wavelengths. ~~further comprising a lumen positioned such that said lumen is capable of introducing to said area of interest a lysing system.~~

32. (Amended) The apparatus of claim 31 wherein said detector comprises a photodiode. ~~lysing system comprises an ultrasonic transducer capable of rupturing cell membranes.~~

33. (Cancelled) ~~The apparatus of claim 32 wherein said lysing system comprises a pressurization and evacuation system capable of rupturing a cell membrane.~~

34. (Cancelled) ~~The apparatus of claim 31 wherein said lysing system comprises a mechanical lysing device.~~

35. (Cancelled) ~~The apparatus of claim 34 wherein said mechanical lysing device comprises a lysing head mounted at the distal end of a driveshaft.~~

36. (Cancelled) ~~The apparatus of claim 35 wherein said driveshaft delivers torque and rotary motion to said lysing head from a proximal motor.~~

37. (Cancelled) ~~The apparatus of claim 25 wherein said body-insertable device comprises an implantable device.~~

38. (Cancelled) ~~The apparatus of claim 37 wherein said implantable device comprises a rotary flexible driveshaft having a therapeutic tip terminating in an anchoring device.~~

39. (Cancelled) ~~The apparatus of claim 38 wherein said implantable device further comprises a separable joint between said therapeutic tip such that said therapeutic tip remains within a body after removal of said body-insertable device.~~

40. (Cancelled) ~~The apparatus of claim 39 further comprising a tether such that said tether remains attached to said therapeutic tip after removal of said body-insertable device.~~

41. (Cancelled) ~~The apparatus of claim 40 wherein said tether is capable of transmitting an electrical signal.~~

42. (Cancelled) ~~The apparatus of claim 25 wherein said body-insertable device is delivered to the area of interest by a carrying device.~~

43. (Cancelled) ~~The apparatus of claim 42 wherein said carrying device is selected from the group consisting of a hollow needle, a guide wire, a balloon catheter, an ultrasound catheter, an introducer sheath, and a balloon angioplasty catheter.~~

Clean Copy of All Pending Claims

1. (Amended) A body-insertable apparatus comprising:

an excitation source capable of generating radiation;

at least one probe disposed in a path of said radiation, said probe situated to contact an analyte;

a detector for detecting optical properties of said probe, said detector also for converting optical signals representative of the detected optical properties to electrical signals;

and a housing adapted for reaching an area of interest within a body,

wherein said excitation source, said probe, and said detector are disposed in said housing.

2. (Amended) The apparatus of claim 1 wherein said probe binds to an oligonucleotide.

3. (Amended) The apparatus of claim 1 wherein said probe binds to a protein.

4. The apparatus of claim 1 wherein said probe is fluorescently labeled.

5. The apparatus of claim 1 wherein said probe is attached to a substrate.

6. (Amended) The apparatus of claim 1 wherein said probe comprises an array of sub-probes.

7. (Amended) The apparatus of claim 6 wherein said array comprises a readable polydeoxynucleotide array.

8. (Amended) The apparatus of claim 6 wherein said array is disposed in a plurality of chambers within a frame.

9. The apparatus of claim 8 wherein said frame comprises a molded material.

10. The apparatus of claim 8 wherein said frame comprises a foraminous material.

11. (Amended) The apparatus of claim 1 further comprising optics that affects said path of radiation.

12. (Amended) The apparatus of claim 11 wherein said optics comprises a mirror.

13. (Amended) The apparatus of claim 12 wherein said mirror is adjustable.

14. (Amended) The apparatus of claim 1 wherein said body-insertable apparatus is electrically connected to a processing unit.

15. (Amended) The apparatus of claim 1 wherein said body-insertable apparatus is electrically connected to an amplifier.

16. (Amended) The apparatus of claim 1 wherein said body-insertable apparatus is electrically connected to a display.

17. The apparatus of claim 7 wherein said array is positioned adjacent to said detector.

18. The apparatus of claim 17 wherein said detector comprises a spectrometer module.

19. The apparatus of claim 18 wherein said spectrometer module is encapsulated in an at least partly transparent housing.

20. The apparatus of claim 1 wherein said excitation source comprises a light-emitting diode light source.

21 The apparatus of claim 1 wherein said excitation source provides excitation energy wavelengths in a range from about 1100 nm to about 250 nm.

22. The apparatus of claim 1 wherein said detector comprises a photodiode responsive to light emitted by said probe.

23. The apparatus of claim 1 wherein said detector comprises a light wavelength detection system.

24. The apparatus of claim 23 wherein said light wavelength detection system comprises a bandpass filter.

26. (Amended) The apparatus of claim 1 wherein said body-insertable apparatus comprises a catheter.

27. (Amended) The apparatus of claim 1 wherein said body-insertable apparatus defines one or more lumens extending through the length of said body-insertable apparatus.

28. (Amended) The apparatus of claim 27 wherein said lumen delivers a drug, a reagent or a device to or beyond the distal tip of said body-insertable apparatus.

29. The apparatus of claim 27 wherein said lumen provides suction sufficient to draw an analyte into proximity with said excitation source, said probe and said detector such that said analyte can be analyzed.

30. The apparatus of claim 27 wherein said lumen comprises an infusion lumen.

33. (Amended) The apparatus of claim 1 wherein said detector detects light emission at multiple wavelengths.

34. (Amended) The apparatus of claim 31 wherein said detector comprises a photodiode.

44. (New) A method of performing in vivo examination of a mammalian body, said method comprising:

(a) providing a device comprising an excitation source, at least one probe, a detector and a housing, wherein said excitation source, said probe and said detector are disposed in said housing;

(b) inserting said device into said mammalian body until said probe contacts an analyte in an area of interest;

(c) generating radiation from said excitation source such that said probe is in a path of said radiation;

(d) detecting an optical signal representative of an optical property of said probe through said detector; and

(e) converting said optical signal to an electrical signal.

45. (New) The method of claim 44 wherein said analyte comprises an oligonucleotide.

46. (New) The method of claim 44 wherein said analyte comprises a protein.

47. (New) The method of claim 44 wherein said probe is fluorescently labeled.

48. (New) The method of claim 44 wherein said probe is attached to a substrate.

49. (New) The method of claim 44 wherein said probe comprises an array of sub-probes.

50. (New) The method of claim 49 wherein said array comprises a readable polydeoxynucleotide array.

51. (New) The method of claim 49 wherein said array is disposed in a plurality of chambers within a frame.

52. (New) The method of claim 51 wherein said frame comprises a molded material.

53. (New) The method of claim 51 wherein said frame comprises a foraminous material.

54. (New) The method of claim 44 further comprising using optics to affect said path of radiation.

55. (New) The method of claim 54 wherein said step of using optics comprises adjusting a mirror.

56. (New) The method of claim 44 further comprising transmitting and processing said electrical signal.

57. (New) The method of claim 44 further comprising amplifying said electrical signal.

58. (New) The method of claim 44 further comprising displaying said electrical signal.

59. (New) The method of claim 48 further comprising mixing said probe with an ink to form a probe-filled ink and depositing said probe-filled ink upon said substrate.

60. (New) The method of claim 59 further comprising depositing a plurality of probe-filled inks upon said substrate in a specific ink pattern.

61. (New) The method of claim 60 further comprising protecting said ink pattern with a topcoat.

62. (New) The method of claim 61 wherein said topcoat comprises a dissolvable gel.

63. (New) The method of claim 61 wherein said topcoat comprises a polymer material dissolvable only upon application of a solvent.

64. (New) The method of claim 44 wherein said detector comprises a spectrometer module.

65. (New) The method of claim 44 further comprising encapsulating said spectrometer module in an at least partly transparent housing.

66. (New) The method of claim 44 wherein said excitation source comprises a light-emitting diode.

67. (New) The method of claim 44 wherein step (c) comprises generating radiation of wavelengths in a range from about 1100 nm to about 250 nm.

68. (New) The method of claim 44 wherein said detector comprises a photodiode responsive to said optical signal from said probe.

69. (New) The method of claim 44 wherein said detector comprises a light wavelength detection system.

70. (New) The method of claim 69 wherein said light wavelength detection system comprises a bandpass filter.

71. (New) The method of claim 44 wherein said device comprises a catheter.

72. (New) The method of claim 44 wherein said device defines at least one lumen extending through the length of said device.

73. (New) The method of claim 72 further comprising delivering a drug, a reagent or a device through said lumen to or beyond a distal tip of said device to affect said area of interest.

74. (New) The method of claim 72 further comprising using said lumen to provide suction such that said analyte is drawn into contact with said probe.

75. (New) The method of claim 44 further comprising introducing to said area of interest a lysing system to facilitate contact between said analyte and said probe.

76. (New) The method of claim 75 further comprising using ultrasonic energy to rupture a cell membrane at said area of interest.

77. (New) The method of claim 75 further comprising using a pressurization and evacuation system to rupture a cell membrane at said area of interest.

78. (New) The method of claim 75 further comprising using a mechanical force to rupture a cell membrane at said area of interest.

79. (New) The method of claim 78 further comprising using a lysing head driven by a driveshaft to rupture said cell membrane.

80. (New) The method of claim 44 further comprising implanting said device in said mammalian body.

81. (New) The method of claim 44 further comprising anchoring said device in said area of interest through an anchor.

82. (New) The method of claim 81 wherein said anchor comprises a therapeutic tip for administering a therapeutic agent.

83. (New) The method of claim 82 wherein said therapeutic tip is separable from the rest of said device such that said therapeutic tip remains within the area of interest after removal of said device.

84. (New) The method of claim 82 wherein said therapeutic tip is retrievable.

85. (New) The method of claim 84 wherein said therapeutic tip is retrievable through a tether attached to said therapeutic tip.

86. (New) The method of claim 82 further comprising controlling a function of said therapeutic tip from outside said body by transmitting an electrical signal through a tether attached to said therapeutic tip.

87. (New) The method of claim 44 further comprising using a carrying device to deliver said device to the area of interest.

~~89~~ 88. (New) The method of claim 87 wherein said carrying device is selected from the group consisting of a hollow needle, a guide wire, a balloon catheter, an ultrasound catheter, an introducer sheath, and a balloon angioplasty catheter.

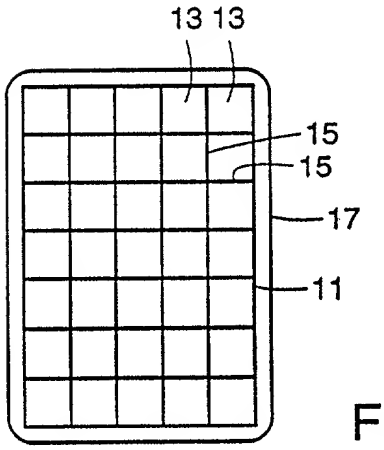


FIG. 1

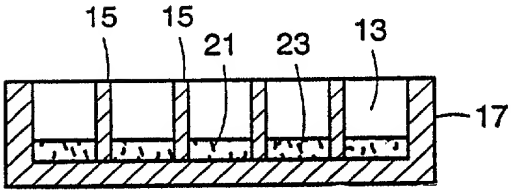


FIG. 1A

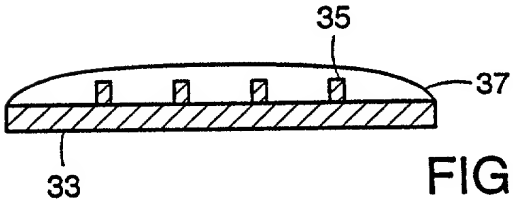


FIG. 1B

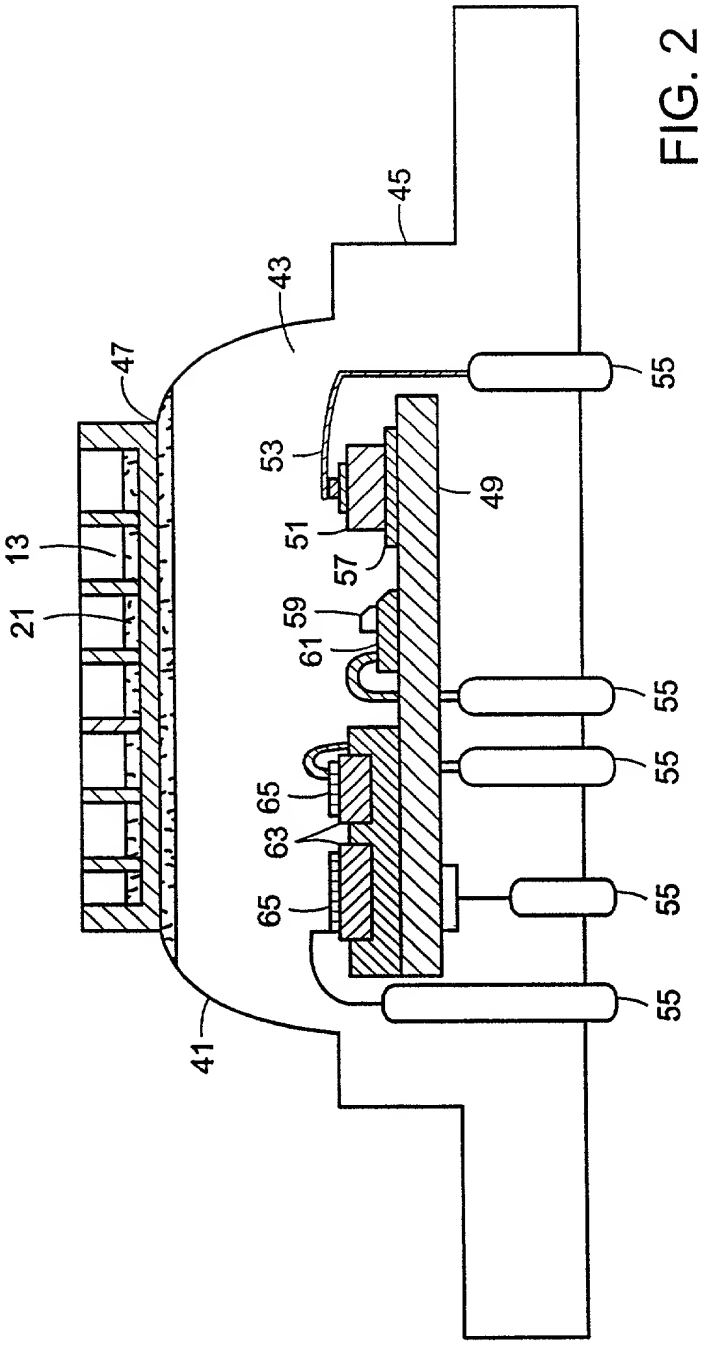
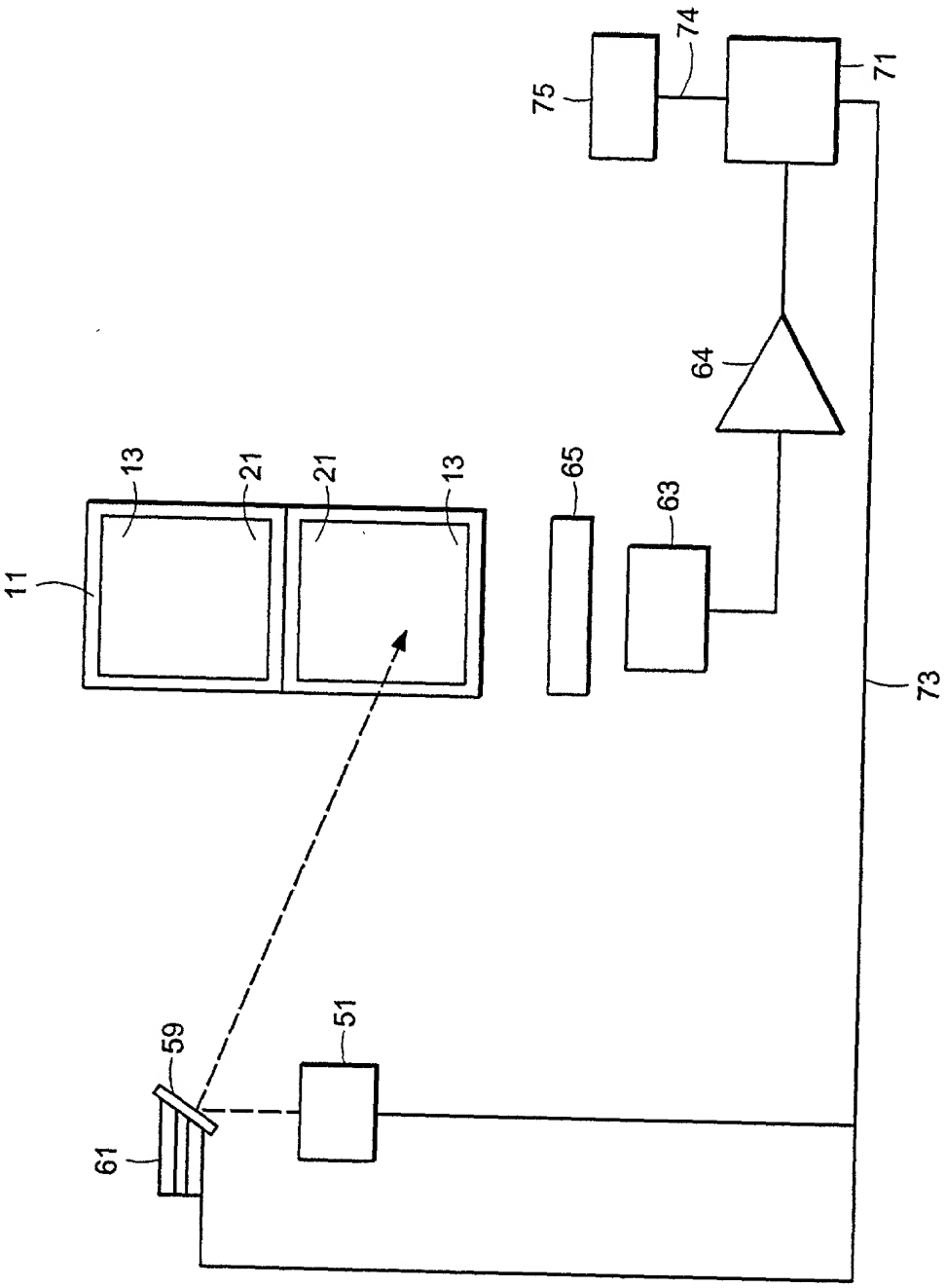


FIG. 2

FIG. 2A



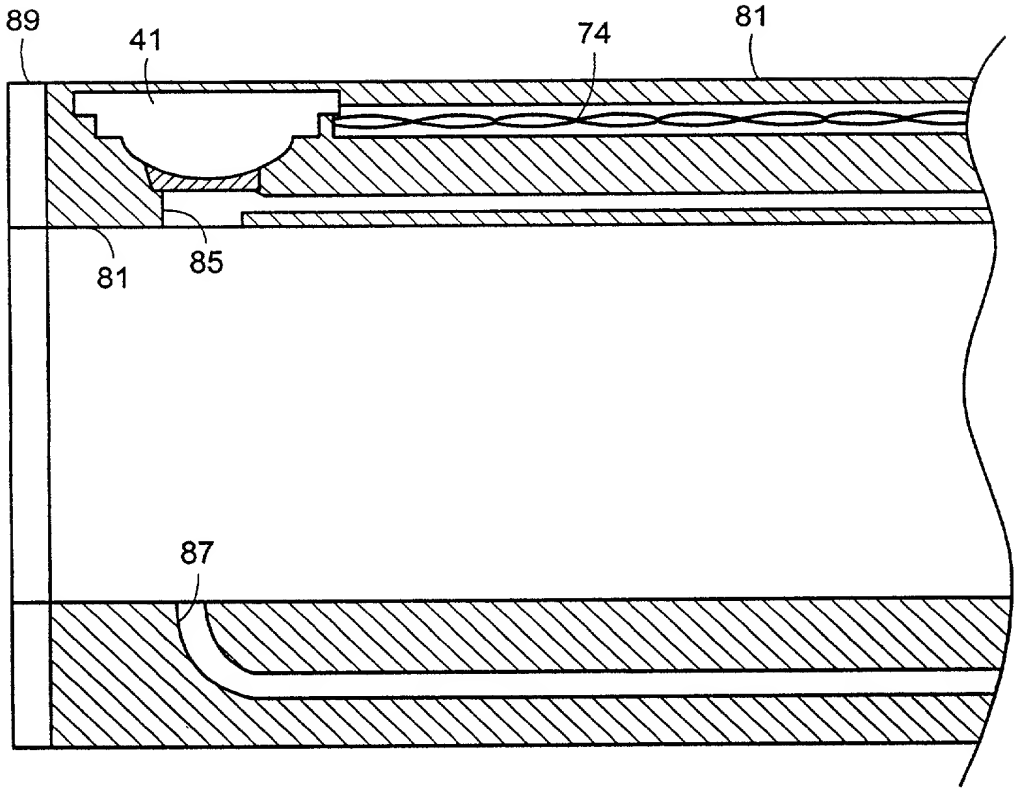


FIG. 3

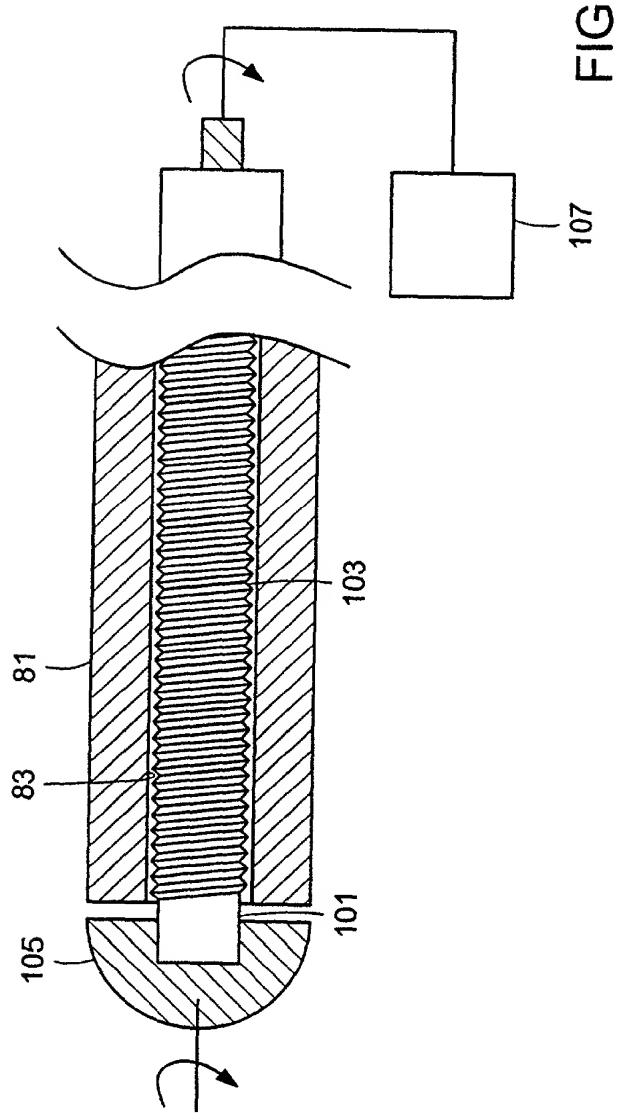


FIG. 4

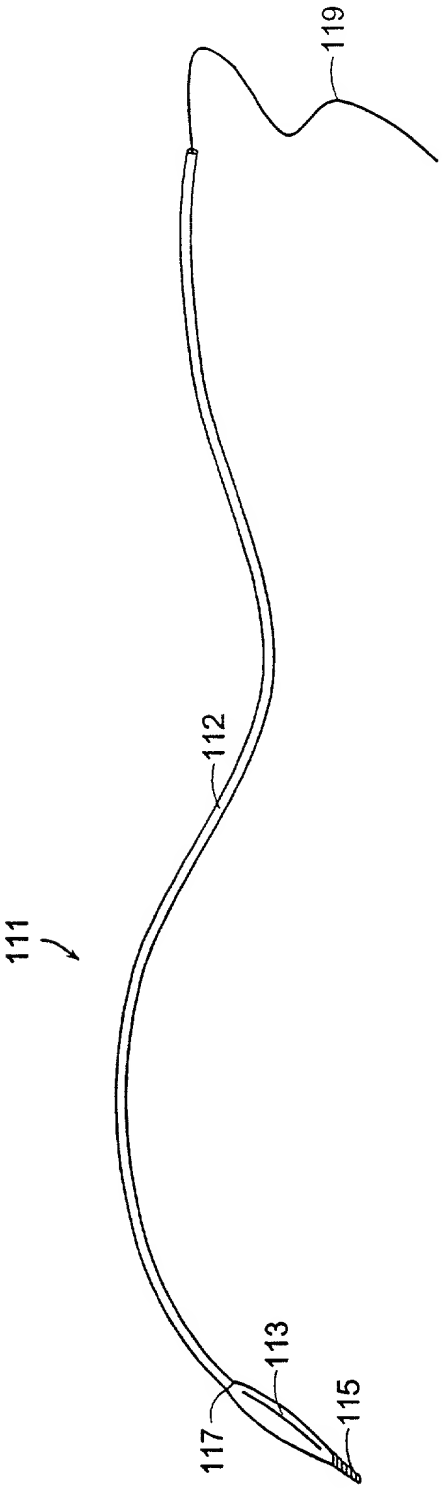


FIG. 5

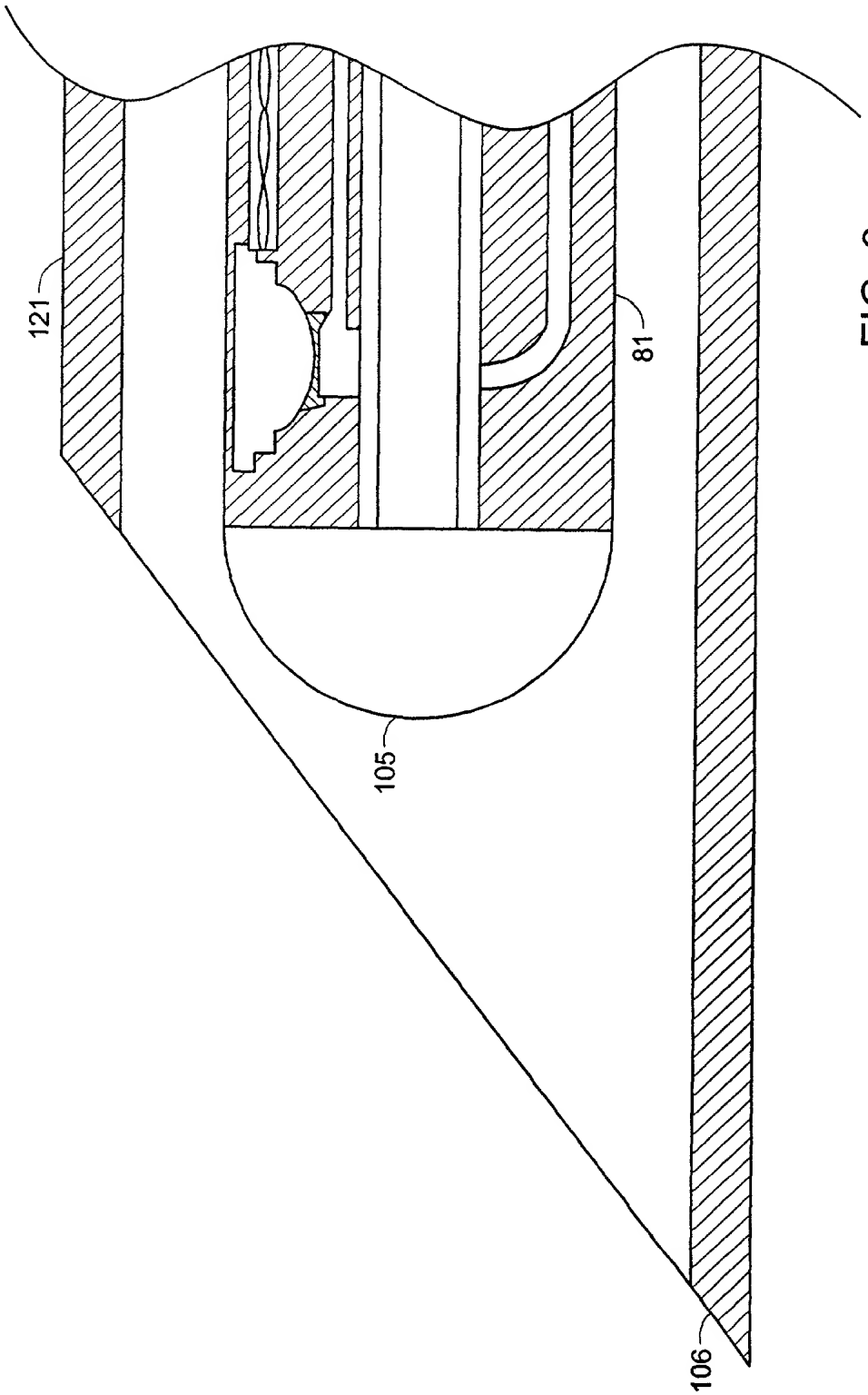


FIG. 6